



# WHY AERATE YOUR DUGOUT

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## WHY IS OXYGEN IMPORTANT?

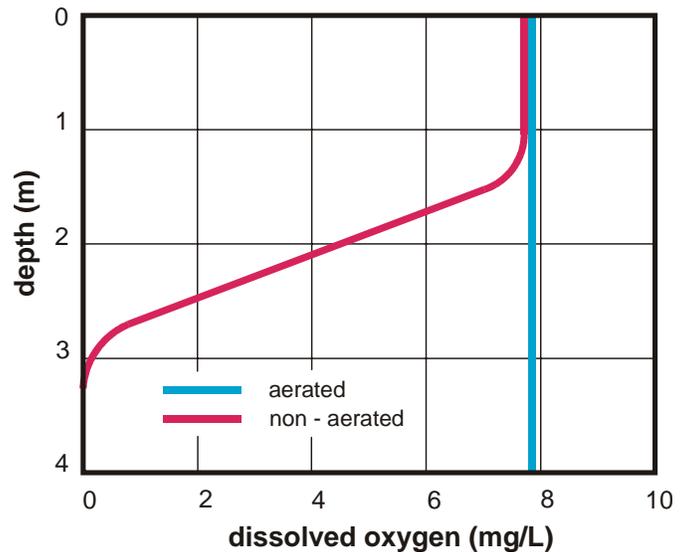
Dugouts are miniature ecosystems, containing all forms of life including plants, animals and bacteria. All of these living organisms require oxygen, so an adequate concentration of oxygen in the water is required to maintain a healthy dugout ecosystem. A healthy dugout produces the best quality water.



A well maintained and healthy dugout produces the best quality water

to the bottom and decompose. This decomposition process consumes large amounts of oxygen and is the reason why oxygen concentrations are lowest at the bottom of a dugout.

### Typical Dugout Oxygen Profiles



## WHEN DOES OXYGEN DEPLETION OCCUR?

In the winter, ice forms on the dugout. This ice seals the surface of the dugouts and prevents oxygen from diffusing from the air to the water. As a result, oxygen depletion is common in the winter when decomposition is occurring. The ice prevents new oxygen from entering the dugout.

Although oxygen depletion is most common in winter, it can also occur in summer. While oxygen continually diffuses from the air to the water, the oxygen moves very slowly in water. Sometimes the rate of oxygen diffusion cannot keep up with the rate of oxygen consumption. This occurs most

## HOW IS THE OXYGEN USED?

All plants and animals use oxygen when they respire or breathe. However, the biggest consumer of oxygen in dugouts is the decomposition of organic material at the bottom of dugouts. When plants and animals die, they fall

frequently when warm temperatures produce very high levels of biological activity which can very rapidly consume the oxygen. This is the most common cause of summer fish kills in dugouts and lakes.

## WHAT HAPPENS WHEN ALL THE OXYGEN IS USED UP?

When all the oxygen is consumed, the decomposition process continues without oxygen. This is called anaerobic decomposition and the compounds it produces cause changes in the water's taste and odour.

In the winter, you know you have anaerobic conditions when the water turns black (may be caused by dissolved iron, manganese and other dissolved or decomposed material) and has a rotten egg smell (caused by hydrogen sulfide gas).

In the summer, you may not know you have anaerobic conditions if your water intake is near the surface of the water. However the water near the bottom of the dugout could be anaerobic resulting in the release of phosphorus and iron from the sediments.

Phosphorus contributes to algae growth in dugouts. As a result, high concentrations of phosphorus cause prolific algae growth. The algae eventually die, decompose, consume more oxygen and result in the recycling of nutrients and renewed algae growth.

Iron levels higher than 0.5 milligrams per litre (>0.5 mg/L) of water stain plumbing fixtures and clothing and also damage water treatment systems. High concentrations of iron also can cause problems for water distribution systems and drip irrigation systems.

## WHY AERATE YOUR DUGOUT?

Aeration augments the natural process of oxygen replacement. It helps ensure that oxygen concentrations remain high enough to prevent the development of anaerobic conditions.

Aeration helps prevent taste and odour problems in the water by avoiding anaerobic conditions. Aeration also

helps prevent the release of phosphorus from sediments. This limits algae growth and reduces the amount of plant material which will ultimately die and decompose. Aeration prevents the release of iron from the sediments and the problems associated with high iron concentrations.

### Typical Winter Dugout Water Quality

PARAMETER	AERATED	NON-AERATED
Dissolved Oxygen (mg/L)	14.3	0.4
Iron (mg/L)	0.04	1.5
Phosphorus (mg/L)	0.05	0.15

In summary, aeration can significantly improve the quality of water in a dugout. Depending on the use being made of the dugout (e.g., household, livestock watering, crop spraying, etc.), aeration can produce aesthetic (by keeping water better tasting) and economic benefits (by improving cattle weight gain).

## WHEN SHOULD YOU AERATE?

Warm summer temperatures can deplete oxygen concentrations very quickly at the bottom of a dugout, so it is best to aerate 24 hours a day.

Remember that anaerobic conditions can develop during the winter and summer. That is why it is important to aerate 365 days per year.

## THE BIG PICTURE

Dugouts represent an important water source on the Prairies. They are used to provide water for drinking, household uses, livestock watering, crop spraying and aquaculture. All of these uses are affected by water quality. Therefore, it is important to maintain the best possible quality of water in your dugout.

Aeration is one of the many tools available to improve dugout water quality. Other techniques include appropriate management of the land surrounding the dugout and

controlling inflows to the dugout. Regardless of what tools might be used, dugout water is not safe for human consumption without additional treatment and disinfection. Aeration can however reduce the cost of these treatment processes and make them more effective.

For more information on dugout aeration see the following **Water Quality Matters** publications: "How To Aerate Your Dugout" and "Myths About Dugout Aeration".

For further information on rural Prairie water quality and treatment technology:

- read the other publications in PFRA's **Water Quality Matters** series;
- visit the PFRA Website at [www.agr.gc.ca/pfra](http://www.agr.gc.ca/pfra)
- get a copy of "Rural Prairie Water Quality: Searching for Solutions for On-Farm Users" available from PFRA;
- read Prairie Water News available from PFRA, or on the Internet at [www.quantumlynx.com/water](http://www.quantumlynx.com/water); or
- **contact your local Prairie Farm Rehabilitation Administration Office**  
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